POLARAD

HANDBOOK OF OPERATING AND MAINTENANCE INSTRUCTIONS

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METROLOGY
LABORATORY

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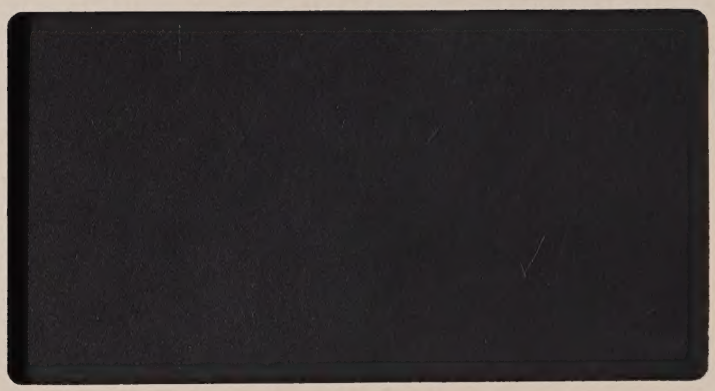

POLARAD

PROVEN RELIABILITY

INSTRUCTION MANUAL

MICROWAVE SIGNAL SOURCE MODEL SSX-A

A3-277
METROLOGY
LABORATORY

SERIAL NO'S 101 TO 254

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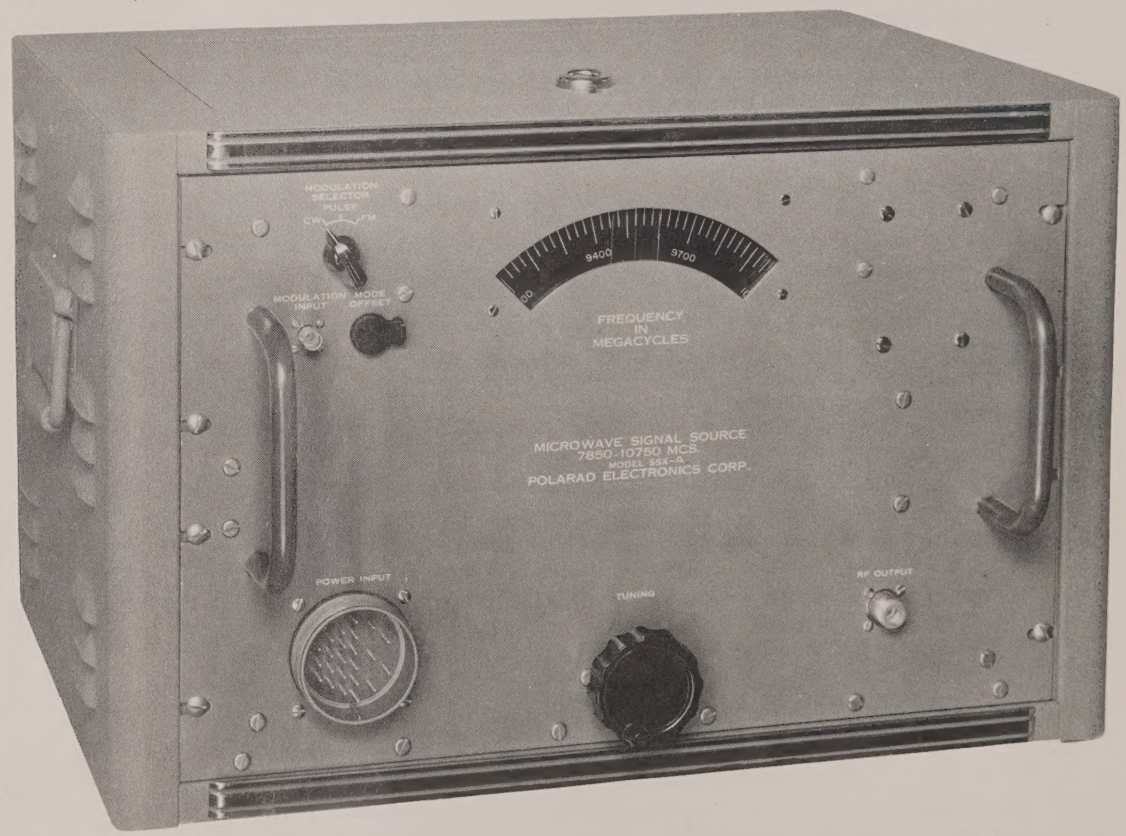


Figure 1-1. Model SSX-A Microwave Signal Source

MODEL SSX-A MICROWAVE SIGNAL SOURCE

SECTION I
INTRODUCTION

1-1. SCOPE OF MANUAL.

1-2. This instruction manual contains directions for the installation, operation and maintenance of the Polarad Model SSX-A Microwave Signal Source (figure 1-1). This signal source is one of six Polarad microwave signal sources which provide a reliable source of microwave energy over the frequency range of 650 mc to 11,500 mc. Model SSX-A provides microwave energy from 7,850 mc to 10,750 mc. The manual also contains a listing of the technical characteristics, as well as a brief theory of operation of the equipment. The unit is designed and manufactured by Polarad Electronics Corporation, Long Island City, New York.

1-3. USES OF THE MICROWAVE SIGNAL SOURCE.

1-4. Polarad's Microwave Signal Sources are used wherever a reliable source of microwave energy is desired, such as antenna measurements, standing wave determination, insertion loss, "Q", and gain measurements, etc. The maximum output power is between 10 and 20 db greater than comparable signal generators. This feature permits the measurement of wider ranges of attenuation, of the minor lobes of an antenna, etc., without requiring signal preamplification or other means of increasing receiver sensitivity.

1-5. GENERAL DESCRIPTION.

1-6. The Polarad Model SSX-A contains an external cavity klystron local-oscillator, a modulation circuit and modulator power supply, a potentiometer adjustment panel, and a mechanical drive system. The unit is tuned manually by rotating the single TUNING knob which simultaneously drives a non-contacting choke within the oscillator cavity, a tracking potentiometer for changing reflector voltage automatically, and a tuning dial which indicates frequency in megacycles accurately to ±1%. The chassis and oscillator castings are secured to the front panel. Two U-shaped front panel handles are provided for ease in removing the unit from, or replacing the unit within, its dust cover. The unit may be mounted in an open relay rack which is provided with mounting holes having standard Western Electric spacing. Two chest handles are provided on the sides of the dust cover for carrying purposes.

1-7. The signal source is normally powered from a Polarad Model KX-B Klystron Power Supply. A standard type AN3102A-40-2P receptacle is mounted on the front panel for power input. The Model KX-B Klystron Power Supply is highly regulated to minimize incidental modulation of the klystron. Model KX-B Klystron Power Supply selects the proper voltages for the signal source, to which it is connected, by means of a front panel selector switch. If another power supply is used, it should be capable of delivering the power requirements of the signal source since proper voltages must be supplied to maintain the signal source frequency calibration.

NOTE

The klystron oscillator anode is operated at ground potential and accelerating voltages are therefore applied to the klystron cathode. This accelerating voltage is referred to as "anode voltage" in the Model KX-B Klystron Power Supply however, and is monitored by a front panel ANODE VOLTAGE meter. The accelerating voltage is called anode voltage, in this manual.

1-8. TECHNICAL CHARACTERISTICS.

Frequency Range	7,850 mc to 10,750 mc
Tuning Dial Accuracy	Better than ±1%
Power Output Range	14 to 40 mw
Modulation	External (FM or square wave)
Power Input: DC	Approx. -1225 v, -1250 v, -1850 v
AC	6.3 volts, 2 amps; 115 volts, 60 cps
Tube Complement	One QK-205 (5721); two 6X4; one 6AU6; two OB2
Requirements for external square wave modulation:	
Repetition Frequency	100 to 5000 pps
Amplitude	40 volts
Requirements for external frequency modulation:	
Waveform	Sawtooth or sine wave
Frequency	50 to 10,000 cps
Dimensions	14-1/4 high by 23 wide by 17-1/2 deep
Weight	63 lbs

1-9. EQUIPMENT SUPPLIED

a. A Polarad connecting cable, part No. AP12544, for connecting to the Polarad Model KX-B Klystron Power Supply is provided when the signal source is purchased with the KX-B Klystron Power Supply.

b. When purchased separately, a mating plug, AN3106-40-2S, with AN3057 cable clamps, is provided.

c. A wrench kit, Polarad part No. A25109, is supplied with each signal source.

SECTION II
OPERATION

2-1. OPERATING CONTROLS (See figure 1-1).

2-2. All operating controls are located on the front panel. Table 2-1 lists the controls and their functions.

TABLE 2-1. OPERATING CONTROLS

Control	Function
TUNING	Controls the operating frequency, as indicated on the direct-reading frequency dial
MODULATION SELECTOR	Selects the internal circuits to permit external square wave modulation, f-m modulation, or CW operation.
MODE OFFSET	This control determines reflector voltage during the "off" interval, in square wave modulation
POWER ADJ	Adjusts the position of the attenuator in the oscillator cavity, for maximum output at each frequency.

2-3. OPERATING PROCEDURE.

2-4. SETTING-UP THE EQUIPMENT.

a. Connect the power cable. When using the Polarad Model KX-B Klystron Power Supply, set the power supply ON-OFF switch to ON.

CAUTION

If the reflector supply voltage is not present within thirty (30) seconds from the time the power is applied, turn the ON-OFF switch of the Model KX-B Klystron Power Supply to OFF.

b. With a power supply other than the Model KX-B Klystron Power Supply, apply the potentials in the following sequence:

(1) Heater voltage (6.3 v ac).
(2) Reflector supply voltage (negative 600 volts with respect to cathode).
(3) Control grid supply voltage (range from positive 25 volts to 0 volts with reference to cathode).
(4) Anode voltage (negative 1250 volts).

c. After a ten-minute warm-up period, the CATHODE CURRENT meter of the Model KX-B Klystron Power Supply should read 22 ma; if this reading is not obtained, adjust the INCREASE CATHODE CURRENT control until this meter indicates 22 ma.

2-5. CW OPERATION. To operate the equipment as a source of cw microwave energy, set up the equipment as directed in paragraph 2-4, above, and proceed as follows:

a. Set the MODULATION SELECTOR to CW position and rotate the POWER ADJ control completely counterclockwise.

b. Rotate the TUNING dial to the desired frequency, and adjust the POWER ADJ control to obtain the desired level of output power.

CAUTION

Inserting the attenuator too far into the cavity, at some frequencies, will stop oscillation. Always advance the attenuator from the counterclockwise position. The position of the attenuator will have a second order effect on signal frequency.

2-6. FM OPERATION. To frequency modulate the output, turn the MODULATION SELECTOR to FM position, and apply a modulating signal from an external source into the front panel MODULATION INPUT jack. The frequency of the external modulating source may be within the range of 50 to 10,000 cps.

2-7. SQUARE WAVE MODULATED OPERATION. To obtain square wave modulated output, proceed as follows:

a. First check the MODE OFFSET control as directed in paragraph 4-5.
b. Turn the MODULATION SELECTOR switch to its SQ. WAVE position.
c. Apply a square wave signal from an external source to the MODULATION INPUT jack. The repetition frequency of the square wave signal may be within the range of 100 to 5,000 cps, at a peak amplitude up to 40 volts.

2-8. TURNING POWER OFF.

CAUTION

Never turn off the reflector supply voltage before the cathode voltage has been turned off. Failure to observe this precaution may destroy the reflex klystron oscillator tube.

2-9. When using a power supply other than the Polarad Model KX-B Klystron Power Supply, turn off the voltages in the following order:
a. Cathode voltage.
b. Control grid voltage.
c. Reflector supply voltage.
d. Heater power.

2-10. When using the Model KX-B Klystron Power Supply, voltages are automatically discontinued in the proper sequence as the Model KX-B POWER switch is rotated to the OFF position.

SECTION III
PRINCIPLES OF OPERATION

3-1. GENERAL.

3-2. The Model SSX-A Microwave Signal Source is a continuous-wave signal source which provides a signal of known frequency in the range from 7,850 to 10,750 mc. Three types of output are available: continuous wave, square-wave modulated, or frequency-modulated. The modulating signal is applied from an external source. The signal source consists, essentially, of a reflex klystron r-f oscillator assembly, a modulating amplifier, and a regulated power supply which furnishes power for the modulator circuit. The function of each circuit is described in paragraphs 3-3 through 3-23, below.

3-3. KLYSTRON OSCILLATOR (See figure 4-8).

3-4. The r-f oscillator tube, V1, is a type 5721 (QK-205) velocity-modulated reflex klystron, operating in an external resonant cavity. The cavity is at 3/4 wave length. A 4-3/4 klystron reflector mode is employed throughout the frequency range. The resonant cavity connects to two of the klystron electrodes, called resonator grids. The resonator grids are physically separated from the cathode by an accelerator grid, which serves to speed up the flow of electrons from the cathode. The reflector (or repeller) electrode, located on the other side of the resonator grids, is connected to a source of high negative potential. The repeller serves to reflect (or repel) the streams of electrons back towards the cathode.

3-5. The resonant cavity used with the klystron is tuned by means of a non-contacting shorted type of choke, which is actuated by a friction drive mechanism, as described in paragraph 3-23, below. The accelerator grid potential is adjusted by a potentiometer connected between the cathode and a potential source which is approximately 25 volts positive, with respect to the cathode. The voltage applied to the reflector electrode is varied, to track simultaneously with the tuning dial rotation, by means of tracking potentiometer R9. The Low Limit (R16) and High Limit (R11) potentiometers are set to maintain the proper voltage range. The output of the oscillator is controlled by means of a variable attenuator, which is inserted at the proper point in the resonant cavity to produce the maximum signal amplitude. The position of the front panel POWER ADJ control knob determines the location of the variable attenuator.

3-6. KLYSTRON CAVITY.

3-7. The external resonant cavity is in the form of a coaxial transmission line, and consists of two cylinders (one concentric with the other). The klystron is inserted at one end of this line so that the first resonator grid (nearest the cathode) makes contact with the outer cylinder. At the other end, the circuit is completed by a movable non-contacting shorted type of choke. The position of this choke determines the electrical dimensions of the cavity and, therefore, the resonant frequency of the cavity. The resonator grids represent a small amount of capacity across the resonant cavity, and permit the cavity dimension to be somewhat shorter in physical length than would otherwise be required.

3-8. DETAILED CIRCUIT ANALYSIS (See figure 4-8).

3-9. When the klystron is energized, the initial and random current variations in the tube start the resonant circuit into oscillation. As the electrons stream past the resonator grids, they are subjected to the periodic variations of the resonant electric field existing between the grids. When the electrons pass through the electric field between the resonator grids, some are speeded up when the field is positive, while those passing through are slowed down when the field swings negative. While the total density of the stream of electrons is always the same, along any given part of the stream, the density is found to vary in groups of electrons, with some moving somewhat faster than others.

3-10. The electrons move past the resonator grids and approach the highly negative repeller electrode, some at a higher rate of speed than others. The high negative potential of the repeller causes the electrons to reverse their direction of travel, and proceed back toward the resonator grids. The faster electrons travel further toward the repeller, and take a longer time to return to the interaction space. But, since the faster-moving electrons have originally passed the grids at an earlier time than the slower-moving electrons, the faster-moving electrons return to the grids at the same time as the slower-moving electrons.

3-11. Therefore, both types of electrons (fast and slow-moving) tend to bunch up as they return to the resonator grids. The bunches tend to center at those electrons which initially passed the resonant field when the r-f voltage across it was approaching zero. If the bunched electrons arrive at the grids when the field is at a maximum positive, they will encounter maximum opposition to their movement across this field, and they will give up energy to the tank circuit. This energy replaces circuit losses and sustains oscillation.

3-12. It is important to note that the time it takes for the electrons to return from their journey toward the repeller is determined by the magnitude of the repeller voltage. In addition, the optimum time for sustained oscillation is an integral number of cycles

plus three quarters of a cycle (such as 1-3/4, 2-3/4, 3-3/4, 4-3/4, etc.) between successive crossings of the space between the resonator grids by the same electrons.

3-13. FREQUENCY CONTROL (See figure 3-1).

3-14. At any given setting of the cavity, there will be an optimum value of repeller voltage which will cause the bunched electrons to arrive at the resonator grids at the proper time. In order to achieve these settings simultaneously, a mechanical arrangement is used. As the tuning dial is rotated, the repeller tracking potentiometer, R9, is simultaneously rotated with the dial, permitting the repeller voltage to be varied over a range of from approximately minus 1250 volts to approximately minus 1850 volts.

3-15. PROTECTIVE DIODE (See figure 4-8).

3-16. For proper operation of the klystron and for safety reasons, the repeller voltage must never be allowed to become positive with respect to the cathode. A circuit, using a type 6X4 rectifier, is employed as a protective diode and is connected between the cathode, pin 3, and the repeller electrode of the klystron oscillator.

3-17. If the repeller voltage should swing positive for any reason, protective diode V2 will conduct. The return circuit for V2 (consisting of R2, R4, and R3) will have a voltage developed across it. Since the plate-to-cathode resistance of diode V2 is much smaller than the plate load resistors when the diode is in a conducting state, most of the voltage drop will take place across the load resistors. The potential at the plates of the diode will be of negative polarity, and will satisfy the condition of maintaining the klystron repeller at a negative potential, with respect to its cathode.

3-18. MODULATING CIRCUIT (See figure 4-8).

3-19. With the MODULATION SELECTOR S2 rotated to the CW position, the cathode, pin 7, of modulation amplifier V3 is open-circuited by one section of switch S2, and the modulation amplifier is effectively removed from the circuit. Any signal applied to the front panel MODULATION INPUT jack J2 is connected to chassis ground through the second section of switch S2.

3-20. With the MODULATION SELECTOR S2 rotated to its center SQ. WAVE position, the cathode, pin 7, of modulation amplifier V3 is returned to the center tap of power transformer T1, by one section of switch S2. A square wave input signal, applied to the front panel MODULATION INPUT jack J2, is coupled (through the second section of switch S2) to the grid, pin 1, of modulation amplifier V3. The grid of V3 is clamped to the positive output of the power supply, through fixed resistor R5. With a positive square wave signal applied to the input, circuit action is as follows. The positive-going leading edge of a square wave input signal at the grid of V3 develops a voltage drop at the plate, pin 5, of the amplifier. This change in voltage is direct coupled to the repeller of the klystron tube, and drives the reflector voltage into the region where oscillations are prevented. At the end of the square wave duration, the negative-going trailing edge of the applied signal drives modulation amplifier V3 to cutoff, and the voltage at the klystron repeller is restored to its normal value (as in CW operation). The front panel MODE OFFSET control R4 is used to set the repeller voltage to that value which prevents the klystron from oscillating during one-half of each square wave cycle. During the other half cycle, the repeller voltage is clamped to the value existing in cw operation. (Refer to paragraph 4-10 for adjustment instructions.)

3-21. With the MODULATION SELECTOR S2 rotated to its FM position, the cathode, pin 7, of modulation amplifier V3 is again open-circuited by one section of switch S2, and the modulation amplifier is effectively removed from the circuit. An f-m input signal, applied to the front panel MODULATION INPUT jack J2, is coupled (through the second section of switch S2) to the repeller electrode of the klystron tube. The percentage of deviation from the center frequency of operation is dependent on the amplitude of the applied modulating voltage.

3-22. MECHANICAL DRIVE SYSTEM.

3-23. The main drive shaft is friction driven by the TUNING knob through a planetary drive and disc which, together, introduce a reduction ratio of approximately 40:1. The main shaft drives the tuning dial, the tracking potentiometer, and the oscillator tuning cam. This oscillator tuning cam, in accordance with its contour, controls the setting of the oscillator choke assembly through a spring-loaded shaft.

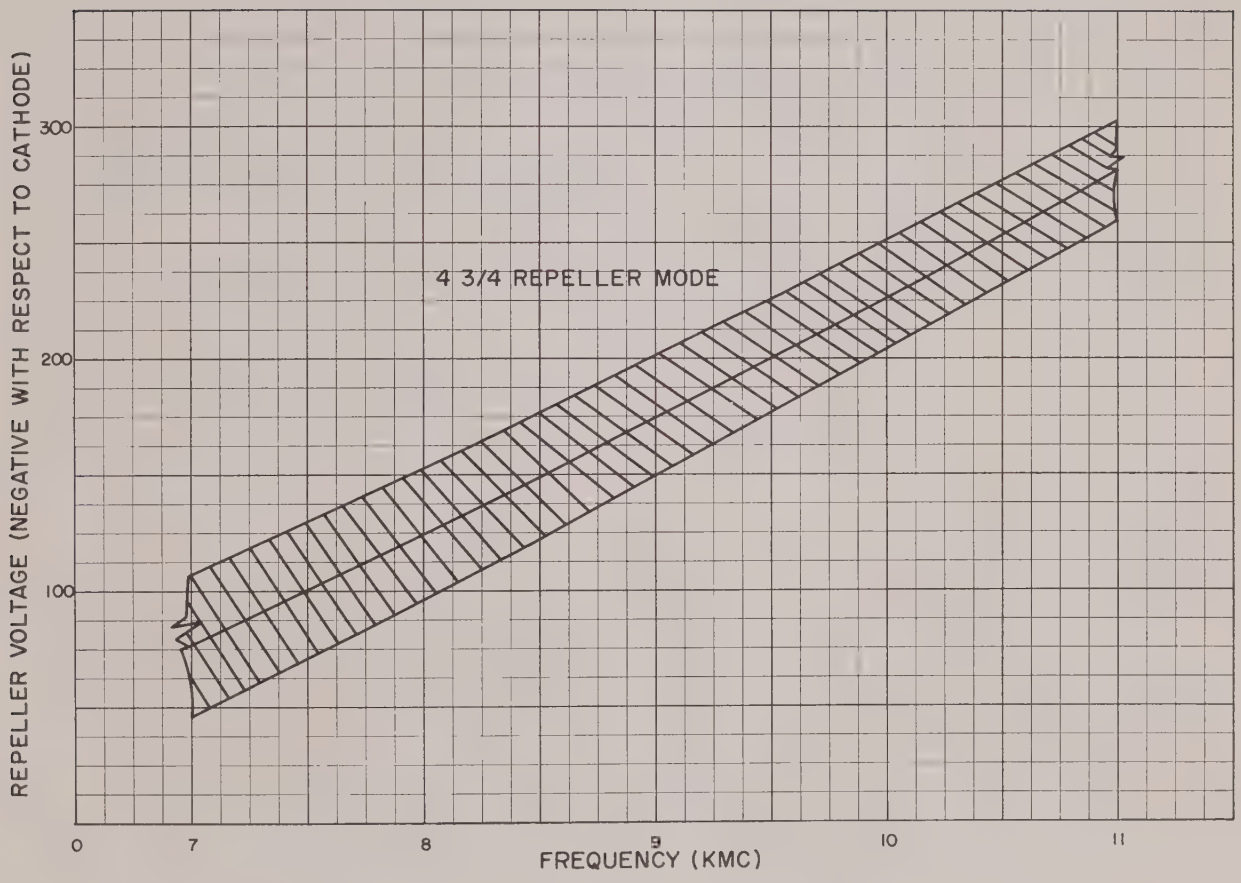


Figure 3-1. Repeller Voltage Characteristic Curve

SECTION IV
MAINTENANCE

4-1. GENERAL.

4-2. This section covers corrective maintenance for the signal source. Included are the instructions for replacing the klystron oscillator tube, the alignment procedure required after installing a new klystron tube, and the adjustment of the MODE OFFSET control. The material contained in this section is to be used in conjunction with the schematic circuit diagram, figure 4-8. Specific reference to this diagram is made throughout the text, where applicable.

WARNING

Application of power to this signal source results in very high voltages which are dangerous to life. Personnel must observe all safety precautions at all times. Do not attempt to remove the klystron tube from its cavity when operating power is ON.

4-3. PRE-OPERATIONAL CHECKS.

a. Examine all tubes, except the klystron, to see that they are firmly seated in their tube sockets.

b. Check that the rotation of the TUNING knob throughout its range, in both clockwise and counterclockwise rotation, is smooth and continuous; the knob must be tight on its shaft.

c. Examine all plugs and connectors to see that they are firmly seated and screwed tight.

d. Rotate the POWER ADJ control and observe that the attenuator moves up and down in its tube.

e. With operating power off, check that the klystron protective cover, on the right side of the oscillator cavity, is firmly in place.

4-4. KLYSTRON TUBE REPLACEMENT.

NOTE

The klystron tube should be removed only after all other checks, including a check of the repeller tracking voltages, as directed in table 4-1, have been made.

4-5. GENERAL. The klystron tube is partially seated within the oscillator cavity, which is assembled on the casting directly to the rear of the r-f unit front panel. The replacement procedure follows.

4-6. KLYSTRON TUBE REMOVAL.

a. BE SURE TO TURN OPERATING POWER OFF. Throw the POWER switch on the klystron power supply to the OFF position. In addition, remove the klystron power unit cable from the POWER INPUT receptacle, on the signal source front panel.

b. Gently pull the tube socket assembly away from the base of the klystron tube.

c. Use the spanner, supplied with the equipment, to loosen the knurled collar at the end of the cavity. DO NOT REMOVE THE COLLAR COMPLETELY.

d. Grasp the projecting end of the klystron tube, gently rotating it in a clockwise direction while simultaneously withdrawing the tube from its spring finger holders within the cavity.

e. Remove the repeller lead from the top of the tube.

f. With operating power OFF, rotate the INCREASE CATHODE CURRENT screwdriver control to its extreme counterclockwise position (control is located on the adjustment panel).

4-7. KLYSTRON TUBE INSTALLATION.

a. Connect the repeller lead to the top of the tube.

b. Insert the tube carefully within the center of the cavity. Press the tube all the way in, rotating clockwise against a noticeable resistance as the internal contact ring-fingers make engagement, until it meets a positive stop.

c. Then re-tighten the large knurled collar, using the spanner.

d. Connect the socket to the base of the klystron tube.

4-8. REPELLER VOLTAGE TRACKING ADJUSTMENTS AND FREQUENCY DIAL CALIBRATION (See figures 4-2 and 4-4).

4-9. The repeller voltage tracking procedure which follows assumes that the unit was previously aligned and operating. To set the repeller tracking voltages, a modulator, a phase shift circuit, a voltmeter, a coaxial crystal detector, a tee connector, a wavemeter and a high-gain oscilloscope are required. The preliminary set-up follows:

a. Check the power supply voltage, and adjust as necessary. After a one-minute delay period, the pointers of the three meters on the klystron power unit should deflect as follows:

(1) CATHODE CURRENT - Slight or no deflection.

(2) REFLECTOR VOLTAGE - Minus 600 volts.
(3) ANODE VOLTAGE - Minus 1250 volts.

b. With the power OFF, make the following connections:

(1) Connect the modulator (see figure 4-1) to the MODULATION INPUT jack.
(2) Connect the phase shifting circuit (see figure 4-1) to the EXT HORIZ sweep input of the oscilloscope.
(3) Connect the output of the crystal detector (see figure 4-2) to the vertical input of the oscilloscope.

(4) Complete the set-up shown in figure 4-2.

c. Set the MODULATION SELECTOR to FM position.

d. Refer to table 4-1 to set the repeller tracking voltages, and to table 4-2 for frequency dial calibration.

TABLE 4-1. REPELLER VOLTAGE TRACKING ADJUSTMENTS

Step	Adjustment	Adjustment Location	Normal Indication
1	Set POWER switch to ON position. Wait	Front panel of power supply	All pilot lamps on power supply light
2	Rotate the INCREASE CATHODE CURRENT meter control clockwise until the pointer at the CATHODE CURRENT meter on power unit indicates 22 ma (Re-check and readjust, if necessary, after a 10-minute operating period)	Reflector control board, on rear of oscillator housing (See figure 4-3)	CATHODE CURRENT remains at the 22 ma calibration mark.
3	Rotate TUNING knob to set frequency dial to 9,500 mc	Tuning unit front panel	9,500 mc calibration mark appears under the index hairline
4	Adjust the modulation amplitude	Modulator unit (See figure 4-1)	A single mode pattern appears on the screen (See figure 4-4)
5	Check the frequency by adjusting the wavemeter, until a pip appears in center of mode	Wavemeter	Wavemeter reads within ±1% of dial calibration . If indication is normal, proceed with step 8. If indication is not normal, proceed with step 6
6	Set the wavemeter to 9,500 mc. Loosen the No. 6 set screw which locks the top push-rod adjustment screw. Adjust the push-rod to set the pip in the center of the mode	On oscillator push plate (figure 4-3)	Pip appears in center of mode
7	Lock the push-rod adjustment screw in place, by tightening the No. 6 set screw	On oscillator push plate	The pip should remain centered on the mode
8	Rotate tuning knob to set frequency dial to 10,750 mc	Tuning unit front panel	10,750 mc calibration mark appears under the index hairline
9	Adjust the modulation amplitude and phase control potentiometers	Modulator unit (See figure 4-1)	A single mode pattern appears on the screen (See figure 4-4)
10	Adjust the HIGH LIMIT screwdriver control R11	Reflector control board, on rear of oscillator housing	The mode moves to the center of the screen
11	Rotate tuning knob to low frequency end, at 7,850 mc	Tuning unit front panel	7,850 mc calibration mark appears under the index hairline

TABLE 4-1. REPELLER VOLTAGE TRACKING ADJUSTMENTS (CONTINUED)

Step	Adjustment	Adjustment Location	Normal Indication
12	Adjust the modulation amplitude and phase control potentiometers	Modulator unit. (See figure 4-1)	A single mode pattern appears on the screen
13	Adjust the LOW LIMIT screwdriver control R16	Reflector control board, on rear of oscillator housing	The mode moves to the center of the screen
14	Repeat steps 8 through 13 until no further adjustment is required	------	The modes remain centered without further adjustment, as the steps are repeated
15	Refer to table 4-2, and check the tuning dial calibration		

TABLE 4-2. TUNING DIAL CALIBRATION PROCEDURE

Step	Adjustment	Adjustment Location	Normal Indication
1	With the power OFF, connect the signal source and its test equipment as shown in figure 4-2	------	None
2	Turn the power ON-OFF switch to its ON position	Power supply front panel	1. All lights go on, and proper current and voltage readings appear on the power supply meters 2. A mode appears on the scope
3	Rotate the TUNING knob to the high frequency end of the tuning dial, 10,750 mc, and tune the wavemeter to the same frequency	Signal source front panel and wavemeter knob	A pip appears on the mode
4	Adjust the wavemeter so that the pip appears on the center of the mode	Wavemeter knob	Pip is centered on the mode. If the dial reading is greater than 1% of the wavemeter reading, proceed to step 6
5	Repeat steps 3 and 4 for all frequencies indicated on the tuning dial from 10,750 to 7,850 mc	Signal source front panel and wavemeter knob	Dial frequency should be within 1% of wavemeter frequency at all points with the pip centered on the mode; if not, proceed to step 6
6	Set the dial reading and the wavemeter at 9,500 mc*	Signal source front panel and wavemeter knob	Pip appears on mode
7	Loosen the No. 6 set screw which locks the top push-rod adjustment screw	Oscillator push plate	Pip should remain on the mode
8	Adjust the push-rod adjustment screw to center the mode	On oscillator push plate	The pip should be centered

* Calibrating the dial at this frequency will normally set both the high and low frequency extremes within ±1%. With some klystrons, however, it may be necessary to compensate. For example, the dial might be set to slightly below 9,500 mc to compensate for an out of tolerance (±1%) reading at one extreme. Care must be taken that the other extreme is not set out of tolerance; step 5 should be repeated as a check.

TABLE 4-2. TUNING DIAL CALIBRATION PROCEDURE (CONTINUED)

Step	Adjustment	Adjustment Location	Normal Indication
9	Lock the push-rod adjustment screw in place by tightening the No. 6 set screw	On oscillator push plate	The pip should remain centered on the mode
10	Check the repeller tracking voltages (table 4-1), and repeat steps 3 through 9 of this table	------	Tuning unit should be accurately calibrated within 1%

4-10. MODE OFFSET CONTROL ADJUSTMENT (See figures 4-5 and 4-6).

a. With the MODULATION SELECTOR in SQ. WAVE position, assemble the signal source and test equipment, as shown in figure 4-5.

b. Note the position of the trace on the scope, corresponding to zero input to the scope. (OFF position on Y Attenuator of Model 304H Oscilloscope.) See figure 4-6a.

c. Set the MODULATION SELECTOR to CW; adjust the double stub tuner and power probe for maximum deflection of the trace from the position shown in step b, above. See figure 4-6b.

d. Set the MODULATION SELECTOR to SQ. WAVE. One side of the square wave on the scope display will be at cw level. However, if the MODE OFFSET control is not properly adjusted, the side will not be seen. A waveform such as that shown in figure 4-6d or 4-6e will appear on the scope. If this waveform is obtained, adjust the MODE OFFSET control to obtain a waveform similar to that illustrated in figure 4-6c.

4-11. VOLTAGE AND RESISTANCE MEASUREMENTS (See figures 4-7 and 4-8). Figure 4-7 is a tube socket location diagram, which shows voltage and resistance measurements of the instrument, as an aid in trouble-shooting a malfunctioning equipment. Unless otherwise shown, all measurements are taken with the MODULATION SELECTOR at SQ. WAVE position. Refer to the notes in figure 4-7 for all other conditions of measurement; refer to figure 4-8 for the over-all schematic diagram.

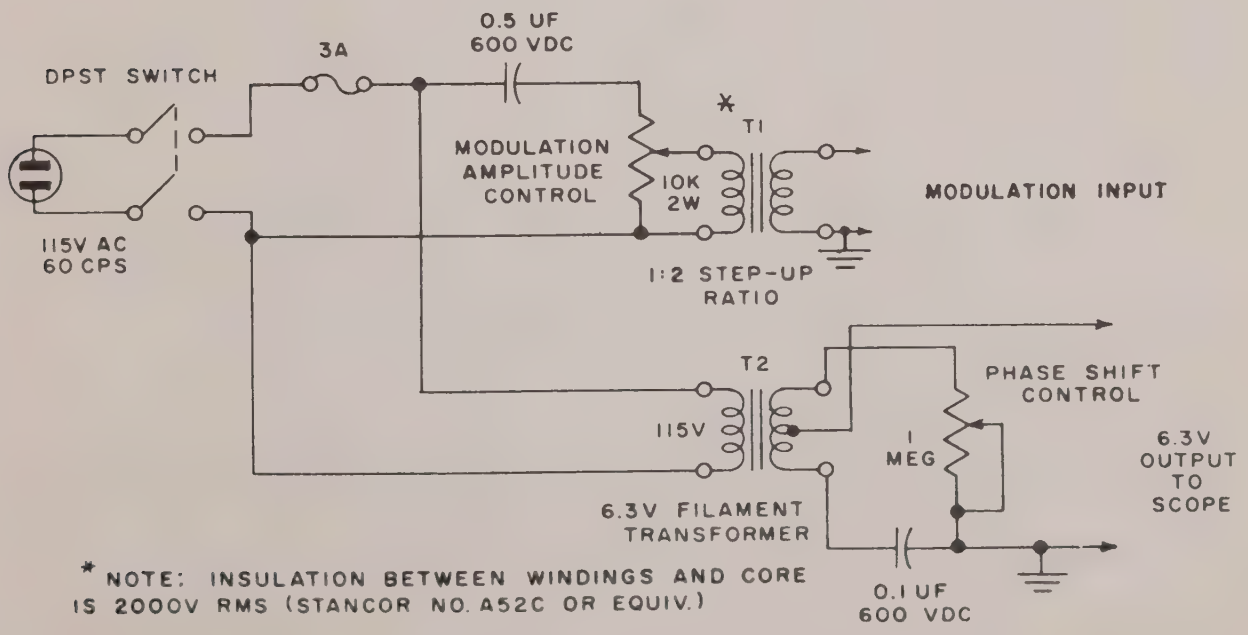


Figure 4-1. Modulator and Phase Shifting Circuits

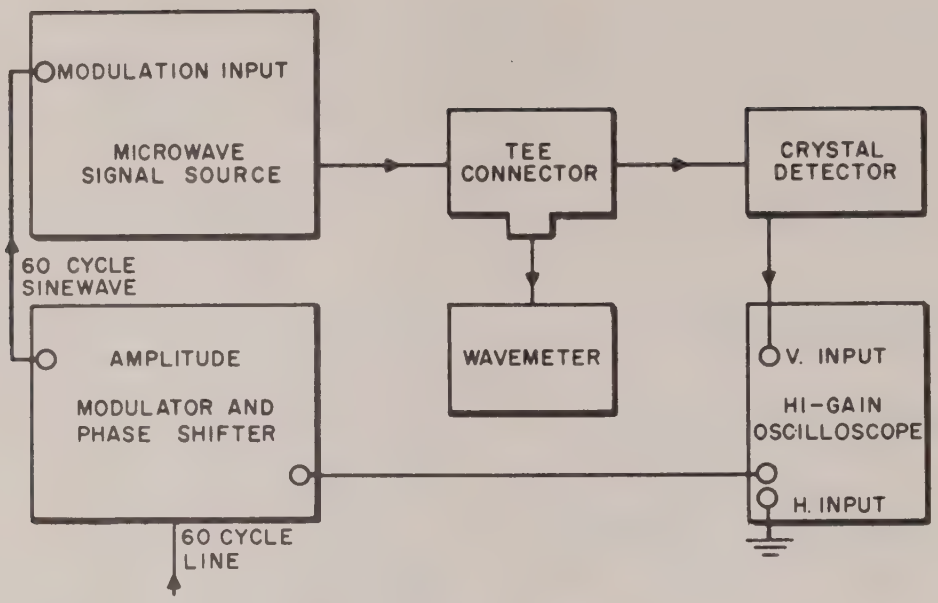


Figure 4-2. Alignment Test Set-Up

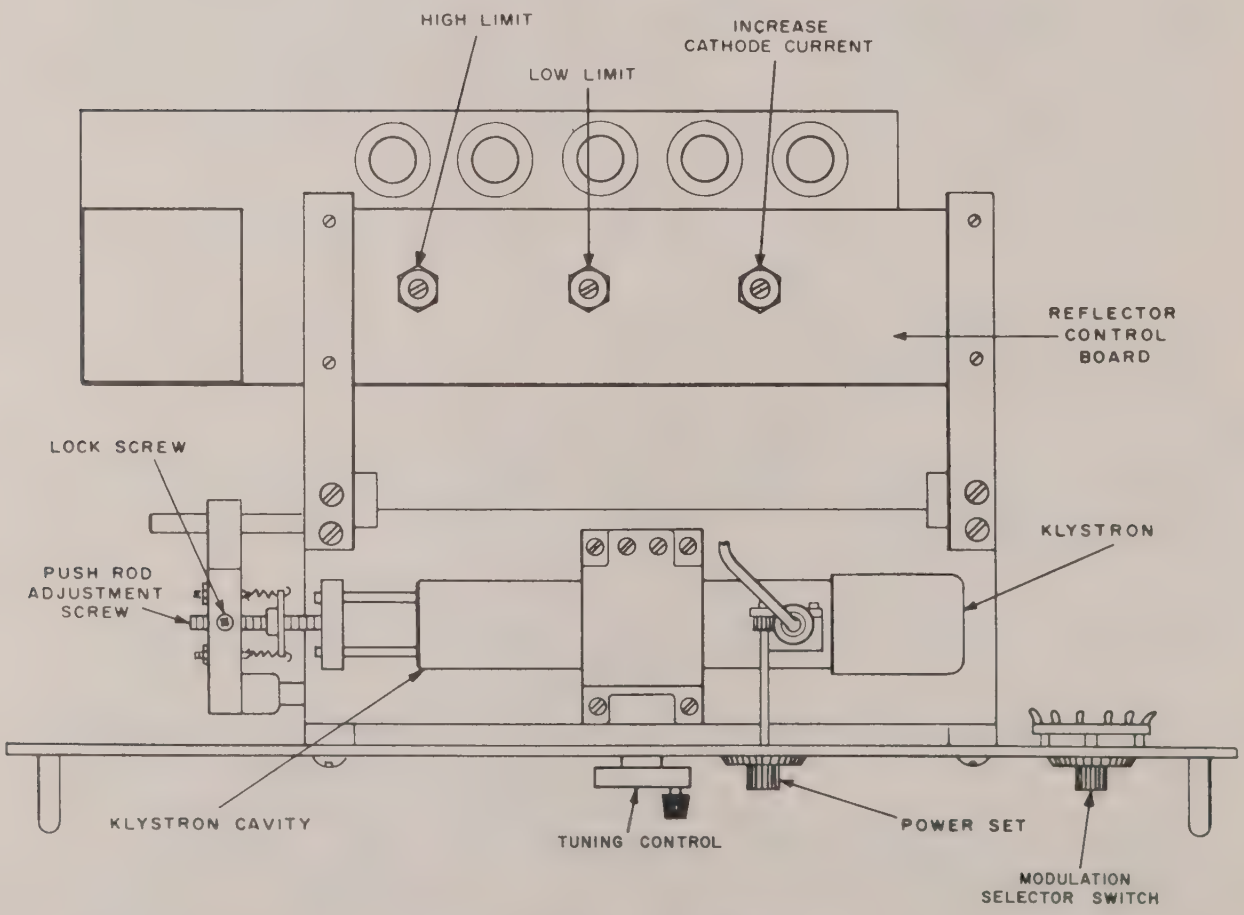


Figure 4-3. Top View of Signal Source

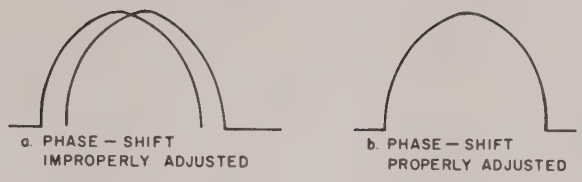


Figure 4-4. Phase Shift Adjustment

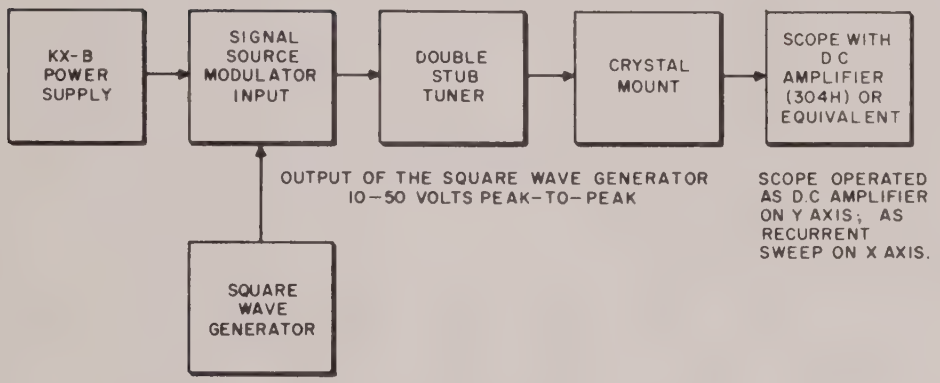


Figure 4-5. Set-Up for Adjustment of MODE OFFSET Control

FIGURE 4-6a ZERO LEVEL ON SCOPE

FIGURE 4-6b ADJUST TUNER FOR MAXIMUM UPWARD DEFLECTION (SEE NOTE)

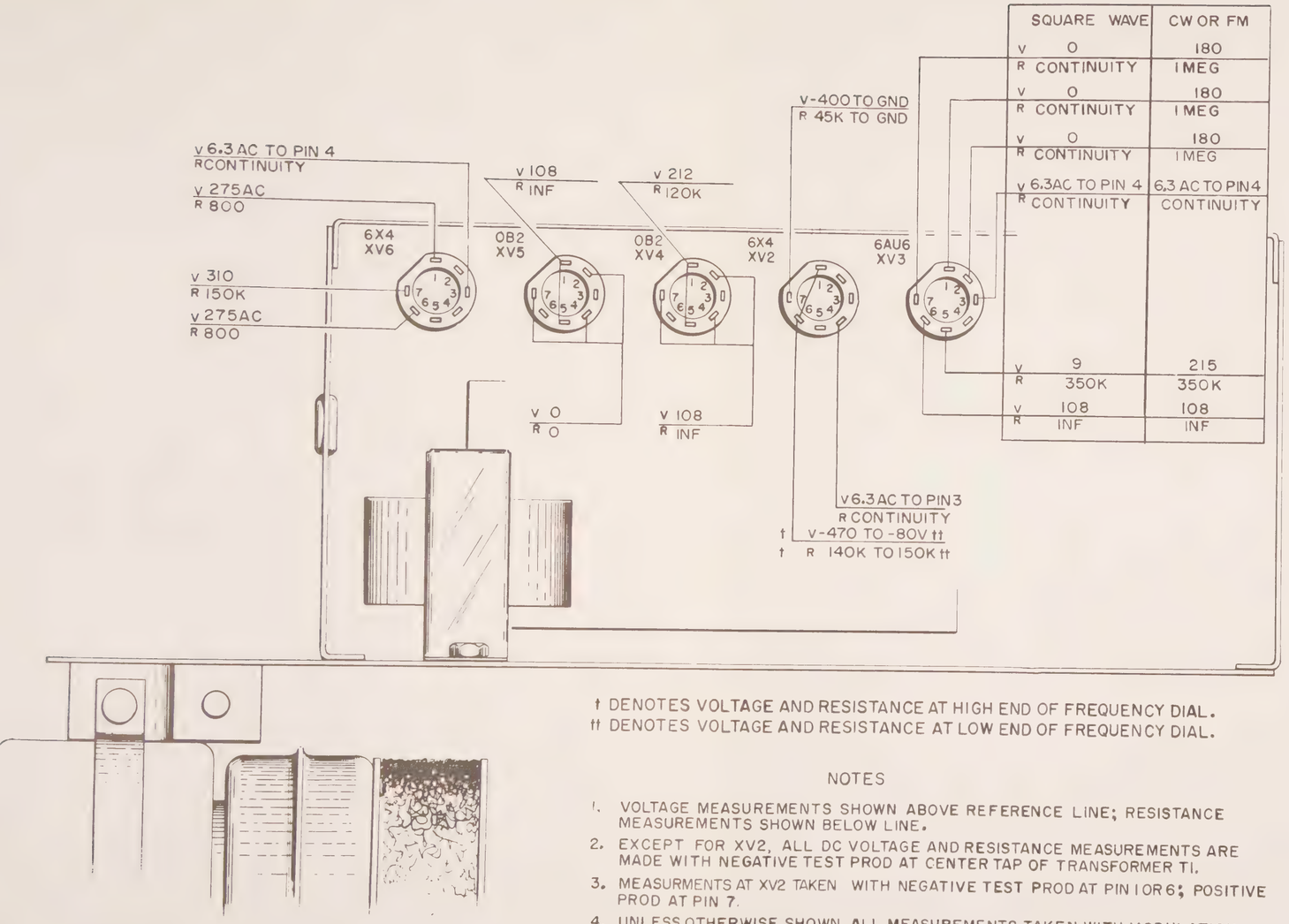
FIGURE 4-6c MODE OFFSET CORRECTLY ADJUSTED

FIGURE 4-6d MODE OFFSET INCORRECTLY ADJUSTED

FIGURE 4-6e

NOTE: THESE ILLUSTRATIONS ASSUME THAT CRYSTAL POLARITY AND SCOPE AMPLIFIERS ARE SUCH AS TO CAUSE UPWARD DEFLECTION ON CW RELATIVE TO ZERO. IF THE DEFLECTION IS REVERSED, ALL FIGURES WILL APPEAR UPSIDE DOWN

Figure 4-6. Typical Waveforms for Adjusting MODE OFFSET Control



	SQUARE WAVE	CW OR FM
v	0	180
R	CONTINUITY	1 MEG
v	0	180
R	CONTINUITY	1 MEG
v	0	180
R	CONTINUITY	1 MEG
v	6.3 AC TO PIN 4	6.3 AC TO PIN 4
R	CONTINUITY	CONTINUITY
v	9	215
R	350K	350K
v	108	108
R	INF	INF

† DENOTES VOLTAGE AND RESISTANCE AT HIGH END OF FREQUENCY DIAL.
†† DENOTES VOLTAGE AND RESISTANCE AT LOW END OF FREQUENCY DIAL.

NOTES

1. VOLTAGE MEASUREMENTS SHOWN ABOVE REFERENCE LINE; RESISTANCE MEASUREMENTS SHOWN BELOW LINE.
2. EXCEPT FOR XV2, ALL DC VOLTAGE AND RESISTANCE MEASUREMENTS ARE MADE WITH NEGATIVE TEST PROD AT CENTER TAP OF TRANSFORMER T1.
3. MEASURMENTS AT XV2 TAKEN WITH NEGATIVE TEST PROD AT PIN 1 OR 6; POSITIVE PROD AT PIN 7.
4. UNLESS OTHERWISE SHOWN, ALL MEASUREMENTS TAKEN WITH MODULATION SELECTOR IN SQ. WAVE POSITION.

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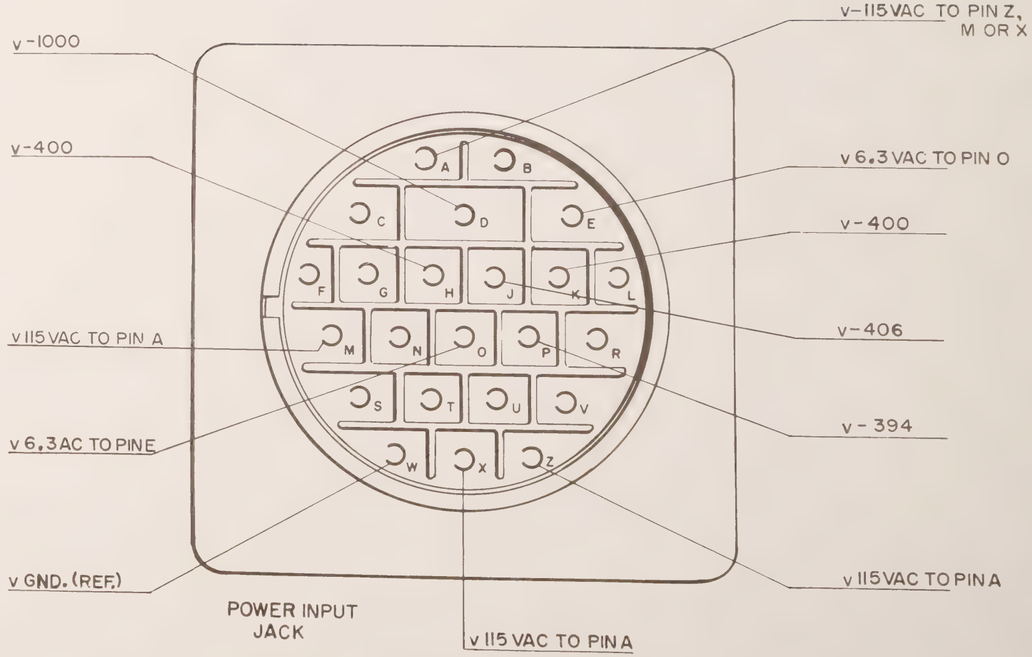

Figure 4-7. Model SSX-A Microwave Signal Source, Voltage and Resistance Measurements

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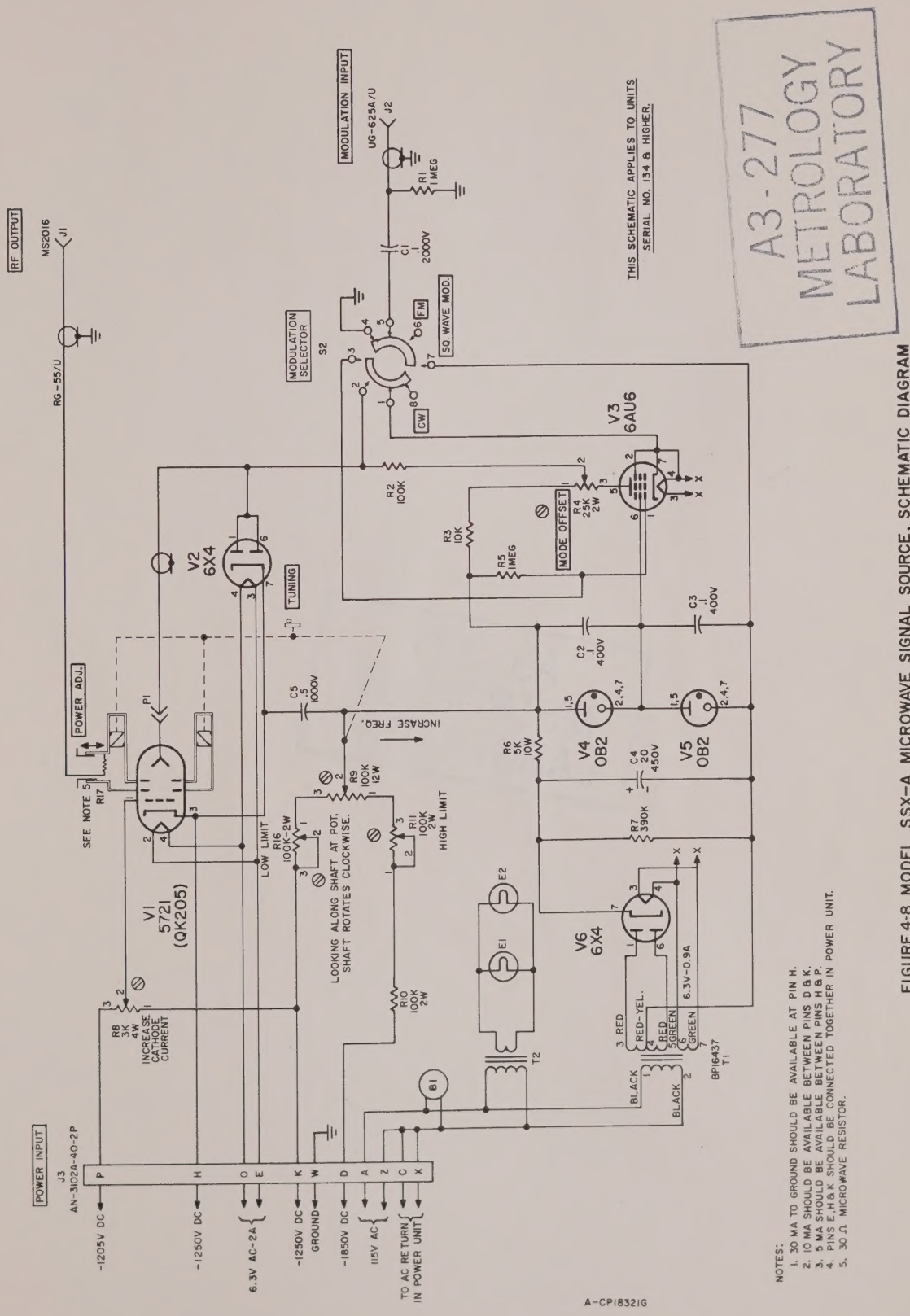

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FIGURE 4-8. MODEL SSX-A MICROWAVE SIGNAL SOURCE, SCHEMATIC DIAGRAM

Figure 4-8. Model SSX-A Microwave Signal Source, Schematic Diagram

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